Approach

- LAWGIBB proposes to utilize methods approved by the North Carolina Department of Environment and Natural Resources (DENR) Division of Water Quality (DWQ).
- To ensure efficiency, cost-effectiveness, and timeliness, LAWGIBB proposes to maximize use of GIS technology and computer database capabilities. Based on our experience in watershed protection and permitting, we propose database and GIS design for optimum compatibility with the City's existing system as well as intended and potential future uses.

LAWGIBB GROUP

Methodology

LAWGIBB proposes to complete the required scope by applying a project-tested methodology, including the following tasks:

- Database Design/Methodology
- Stream Identification
- Stream Field Classification
- Data compilation/GPS/GIS input
- Geographic Information System
- Coordination with the City of Greensboro
- Meetings
- Regulatory Coordination
- Public Coordination
- Presentation(s)
- Report(s) / Maps

LAWGIBB GROUP

Methodology

Database Design/Methodology Development

- Preliminary Work Plan
- City Review
- State (DWQ) Approval
- Field Testing

- Report Plan to public / stakeholder / interest groups
- Final Work Plan will document methods and appropriate approvals

LAWGIBB GROUP

Methodology

Stream Identification

Use available GIS coverages to optimize field effort

Use existing information (e.g. USACE verified delineations, other environmental reports) to avoid redundancy

The actual stream identification will be performed in the field

GPS technology will be used to locate the breakpoints during the data collection phase.

LAWGIBB GROUP

Methodology

Stream Field Classification

A two-phased approach identifying the approximate location of the beginning of intermittent channels and the beginning of perennial channels (equivalent to the termination of intermittent channel status) will be employed.

Current DWQ policy defines perennial streams as streams which display one of the following criteria:

- a calculated positive flow during certain drought events (7Q10 or 30Q2); or
- aquatic vertebrates and large invertebrates (i.e., fish, shellfish, and crayfish).

Intermittent streams are defined by a rating of at least 19 points using Version 2.0 of the DWQ Stream Classification Method dated January19, 1999.

LawGibb Group

Methodology

Stream Field Classification

LAWGIBB will generally sample streams up to approximately 100 feet upstream and 100 feet downstream of the approximate location of the potential intermittent/perennial change.

A standard "D"-shaped dip net may be used to determine the presence or absence of aquatic vertebrates and large invertebrates consistent with DWQ criteria.

At least two (one facing upstream and one facing downstream) digital color photographs will be taken at each location and standard field notes will include date, time, current antecedent weather conditions, as well as any unusual or relevant observations.

The approximate location of the beginning of perennial channel will be identified in the field based on the results of the dip net survey and/or other obvious appropriate regulatory criteria and marked with plastic surveyor's tape, pin flags, or other appropriate means.

This point will be recorded using hand-held GPS units in which significant data will also be directly recorded.

LAWGIBB GROUP

NCDWQ Stream Classification Form

Project Name:		River Basin:		County:		Evaluator:	
DWQ Project Number:		Nearest Named Stream:		Latitude:		Signature:	
Date:		USGS QUAD:		Longitude:		Location/Directions:	

***PLEASE NOTE:** *If evaluator and landowner agree that the feature is a man-made ditch, then use of this form is not necessary. Also, if in the best professional judgement of the evaluator, the feature is a man-made ditch and not a modified natural stream—th*

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Riffle-Pool Sequence?	0	1	2	3
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?	0	1	2	3
3) Are Natural Levees Present?	0	1	2	3
4) Is The Channel Sinuous?	0	1	2	3
5) Is There An Active (Or Relic) Floodplain Present?	0	1	2	3
6) Is The Channel Braided?	0	1	2	3
7) Are Recent Alluvial Deposits Present?	0	1	2	3
8) Is There A Bankfull Bench Present?	0	1	2	3
9) Is A Continuous Bed & Bank Present? *(* **NOTE**: If Bed & Bank Caused By Ditching And **WITHOUT** Sinuosity Then Score=0*)*	0	1	2	3
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map And/Or In Field) Present?	Yes= 3		No= 0	

PRIMARY GEOMORPHOLOGY INDICATOR POINTS: **57**

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is There A Groundwater Flow/Discharge Present?	0	1	2	3

PRIMARY HYDROLOGY INDICATOR POINTS: **6**

III. Biology	Absent	Weak	Moderate	Strong
1) Are Fibrous Roots Present In Streambed?	3	2	1	0
2) Are Rooted Plants Present In Streambed?	3	2	1	0
3) Is Periphyton Present?	0	1	2	3
4) Are Bivalves Present?	0	1	2	3

PRIMARY BIOLOGY INDICATOR POINTS: **24**

(Circle One Number Per Line)

I. Geomorphology	Absent	Weak	Moderate	Strong
1) Is There A Head Cut Present In Channel?	0	0.5	1	1.5
2) Is There A Grade Control Point In Channel?	0	0.5	1	1.5
3) Does Topography Indicate A Natural Drainage Way?	0	0.5	1	1.5

SECONDARY GEOMORPHOLOGY INDICATOR POINTS: **9**

II. Hydrology	Absent	Weak	Moderate	Strong
1) Is This Year's (Or Last's) Leaflitter Present In Streambed?	1.5	1	0.5	0
2) Is Sediment On Plants (Or Debris) Present?	0	0.5	1	1.5
3) Are Wrack Lines Present?	0	0.5	1	1.5
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*	0	0.5	1	1.5
5) Is There Water In Channel During Dry Conditions Or In Growing Season)?	0	0.5	1	1.5
6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)?	Yes= 1.5		No= 0	

SECONDARY HYDROLOGY INDICATOR POINTS: **16.5**

III. Biology	Absent	Weak	Moderate	Strong	
1) Are Fish Present?	0	0.5	1	1.5	
2) Are Amphibians Present?	0	0.5	1	1.5	
3) Are AquaticTurtles Present?	0	0.5	1	1.5	
4) Are Crayfish Present?	0	0.5	1	1.5	
5) Are Macrobenthos Present?	0	0.5	1	1.5	
6) Are Iron Oxidizing Bacteria/Fungus Present?	0	0.5	1	1.5	
7) Is Filamentous Algae Present?	0	0.5	1	1.5	
8) Are Wetland Plants In Streambed? *(* **NOTE**: If Total Absence Of All Plants In Streambed As Noted Above Skip This Step UNLESS SAV Present*).*	SAV 2	Mostly OBL 1	Mostly FACW 0.75	Mostly FAC 0.5	Mostly FACU 0	Mostly UPL 0

SECONDARY BIOLOGY INDICATOR POINTS: **25.25**

TOTAL POINTS *(Primary + Secondary)=* **137.75** *(If Greater Than Or Equal To 19 Points The Stream Is At Least Intermittent)*

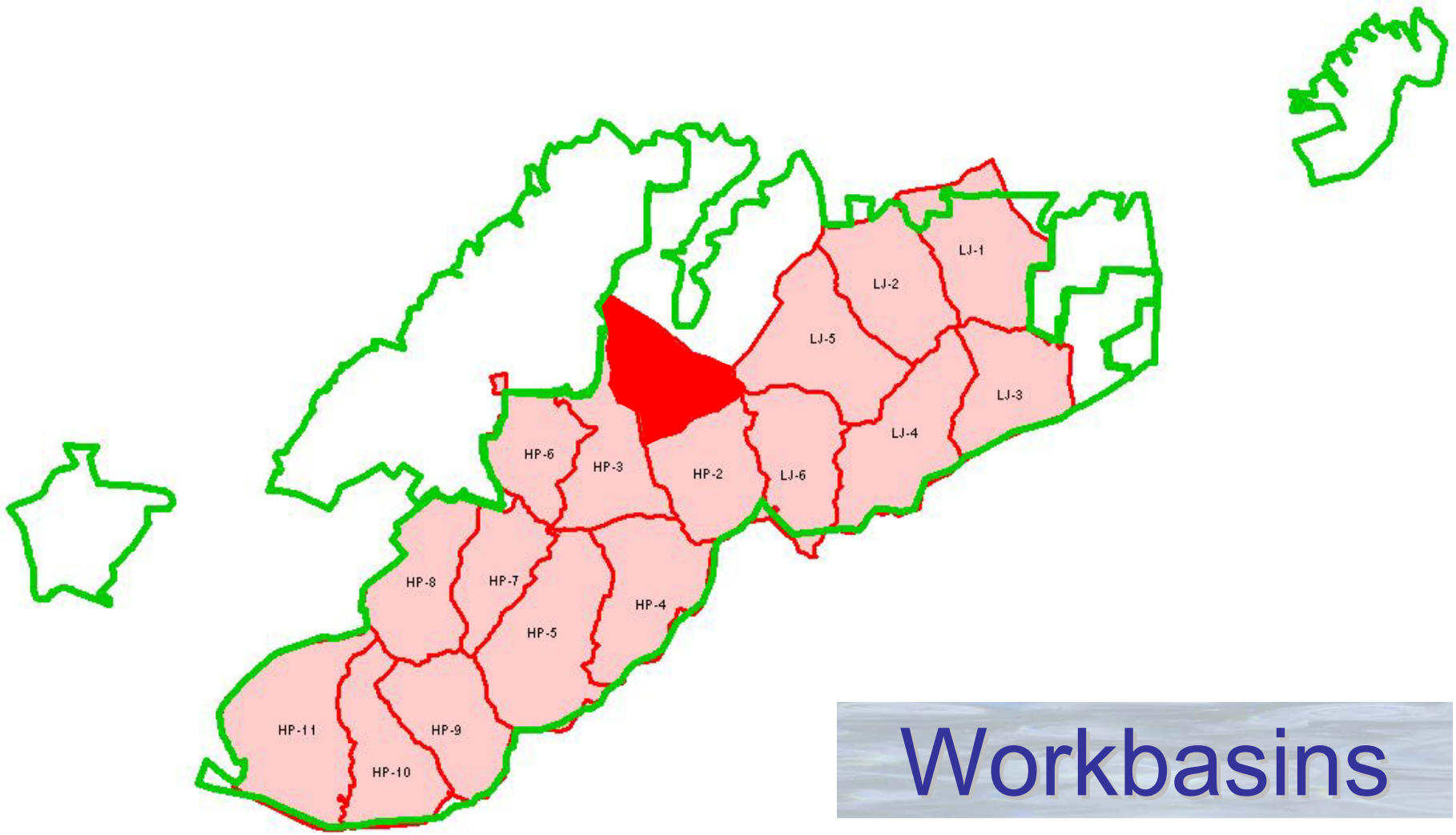
Methodology

The four-tiered weighted scale is designed to encompass the range in variability of each character likely to be observed in the field.

Observations of primary and secondary geomorphologic, hydrologic, and biological indicators will be recorded on the DWQ Stream Classification Form.

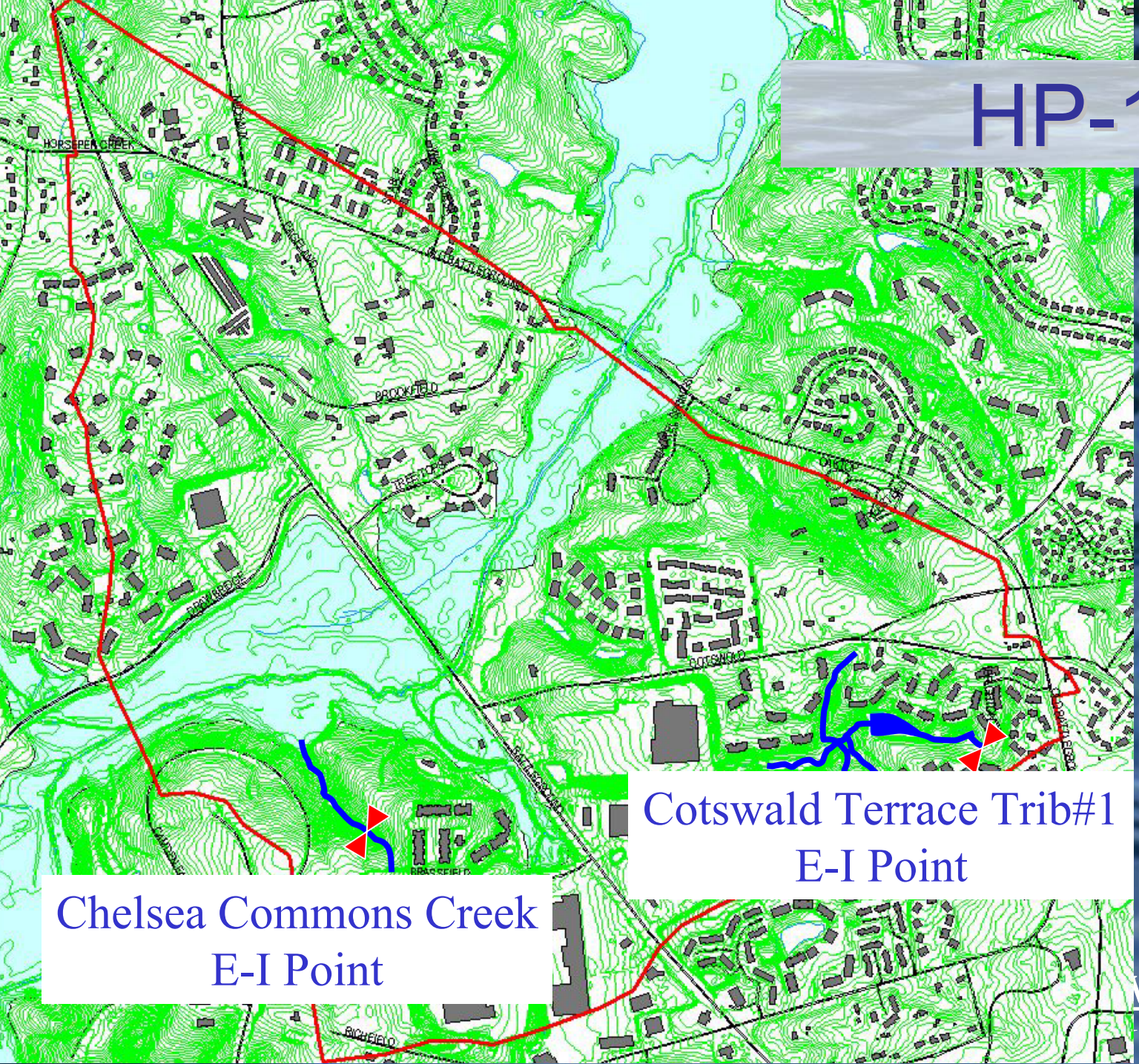
Additional criteria may be added based on coordination with DWQ during Work Plan development Additional information concerning aquatic fauna may be included, based on coordination with DWQ.

LAWGIBB GROUP



Workbasins

LAWGIBB GROUP


HP-1
Cotswald Terrace Trib#1
E-I Point
Chelsea Commons Creek
E-I Point

Chelsea Commons Creek

Ephemeral-Intermittent (E-I) Point, facing upstream.

Orange flag indicates location determined with GPS.

Documented Stream Classification Form applies downstream (at least 100 feet) only.

Upstream rated less than 19

LAWGIBB GROUP

Chelsea Commons Creek

Ephemeral-Intermittent (E-I) Point, facing downstream.

Orange flag indicates location determined with GPS.

Classified as at least Intermittent based on rating of 24

LAWGIBB GROUP

NCDWQ Stream Classification Form

This form has been adapted for use in the City of Greensboro Stormwater Services Water Supply Watershed Protection Area only.

Date:	09/14/00	Subbasin:	HP-1	Nearest Road:	Brassfield Road
Time:	14:51	Stream ID:	Chelsea Commons Cr.		
Evalua	JL, JM	Photo #s:		Location/Directi	Behind Chelsea Commons at Brassfield

Primary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong	Comments
1) Is There A Riffle-Pool Sequence?		1			
2) Is The USDA Texture In Streambed Different From Surrounding Terrain?			2		
3) Are Natural Levees Present?		1			
4) Is The Channel Sinuous?			2		
5) Is There An Active (Or Relic) Floodplain Present?		1			
6) Is The Channel Braided?		1			
7) Are Recent Alluvial Deposits Present?		1			
8) Is There A Bankfull Bench Present?		1			
9) Is A Continuous Bed & Bank Present? *(* **NOTE** : If Bed & Bank Caused By Ditching And **WITHOUT** Sinuosity Then Score=0*)*		1			
10) Is A 2nd Order Or Greater Channel (As Indicated On Topo Map And/Or In Field) Present?	Yes=		No= 0		

PRIMARY GEOMORPHOLOGY INDICATOR POINTS: **11**

II. Hydrology	Absent	Weak	Moderate	Strong	Comments
1) Is There A Groundwater Flow/Discharge Present?		1			

PRIMARY HYDROLOGY INDICATOR POINTS: 1 **1**

III. Biology	Absent	Weak	Moderate	Strong	Comments
1) Are Fibrous Roots Present In Streambed?		2			
2) Are Rooted Plants Present In Streambed?			1		
3) Is Periphyton Present?	0				
4) Are Bivalves Present?	0				

PRIMARY BIOLOGY INDICATOR POINTS: **3**

Secondary Field Indicators: *(Circle One Number Per Line)*

I. Geomorphology	Absent	Weak	Moderate	Strong	Comments
1) Is There A Head Cut Present In Channel?			1		
2) Is There A Grade Control Point In Channel?			1		
3) Does Topography Indicate A Natural Drainage Way?				1.5	

SECONDARY GEOMORPHOLOGY INDICATOR PTS: **3.5**

II. Hydrology	Absent	Weak	Moderate	Strong	Comments
1) Is This Year's (Or Last's) Leaflitter Present In Streambed?			0.5		
2) Is Sediment On Plants (Or Debris) Present?		0.5			
3) Are Wrack Lines Present?		0.5			
4) Is Water In Channel ***And*** >48 Hrs. Since Last ***Known*** Rain? *(*NOTE: If Ditch Indicated In #9 Above Skip This Step And #5 Below*)*		0.5			
5) Is There Water In Channel During Dry Conditions Or In Growing Season)?		0.5			
6) Are Hydric Soils Present In Sides Of Channel (Or In Headcut)? **Yes=** 1.5 **No=**					

SECONDARY HYDROLOGY INDICATOR POINTS: **4**

III. Biology	Absent	Weak	Moderate	Strong	Comments
1) Are Fish Present?	0				
2) Are Amphibians Present?		0.5			
3) Are AquaticTurtles Present?	0				
4) Are Crayfish Present?		0.5			
5) Are Macrobenthos Present?	0				
6) Are Iron Oxidizing Bacteria/Fungus Present?	0	0.5			
7) Is Filamentous Algae Present?	0				

8) Are Wetland Plants In Streambed?	SAV	Mostly OBL	Mostly FACW	Mostly FAC	Mostly FACU	Mostly UPL
(**NOTE** : If Total Absence Of All Plants In Streambed As Noted Above Skip This Step UNLESS SAV Present*).*					0	

SECONDARY BIOLOGY INDICATOR POINTS: **1.5**

TOTAL POINTS (Primary + Secondary)= **24** ***(If Greater Than Or Equal To 19 Points The Stream Is At Least Intermittent)***

ADDITIONAL NOTES

Exposed bedrock:	***Absent***	Weak	Moderate	Strong
Canopy cover:	Absent	Weak	***Moderate***	Strong
Water color:	N/A	***Normal***	Cloudy	Colored
Odor:	N/A	Yes	***No***	

Channel modifications:

Stormwater effects from Chelsea Commons

Weather Conditions:

Overcast, ~ 82 F

Rainfall:

Trace in AM, more expected this evening

Drainage area acreage:

Miscellaneous/anecdotal information:

Stormwater drainage at top of ephemeral channel
Stream underground for ~ 100'
Lower part of reach enters wetland area in Horsepen floodplain
Stream is intermittent and enters braided/wetland area in Horsepen floodplain

LAWGIBB GROUP

Cotswald Terrace Trib#1

Ephemeral-Intermittent (E-I) Point, facing upstream.

Documented Stream Classification Form applies downstream (at least 100 feet) only.

Upstream rated less than 19

Downstream rated 23

LAWGIBB GROUP

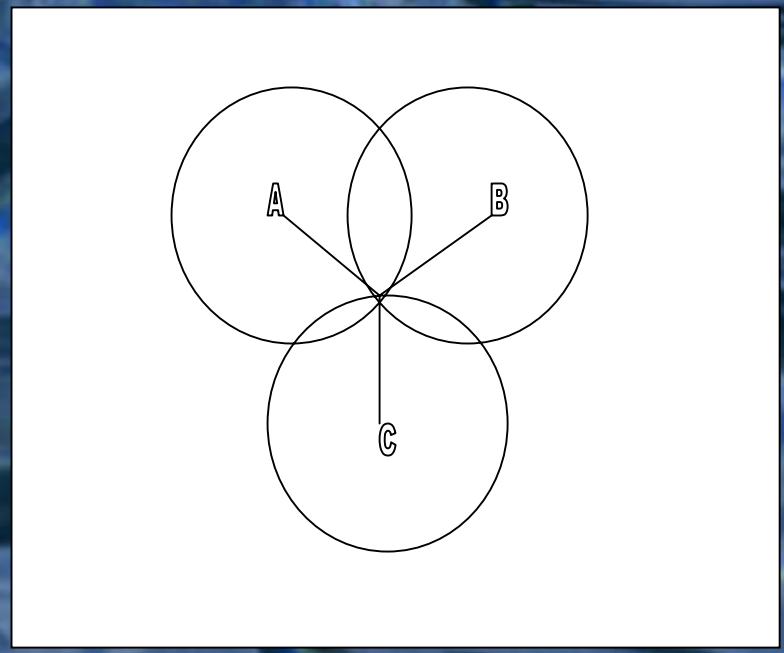
What is a Global Positioning System (GPS)?

- The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 (NAVSTAR) satellites and their ground stations operated by the U.S. Departmen of Defense.
- The 24 operational NAVSTAR satellites orbiting the earth every 12 hours provide worldwide, all-weather, 24 hour time and position information.

LAWGIBB GROUP

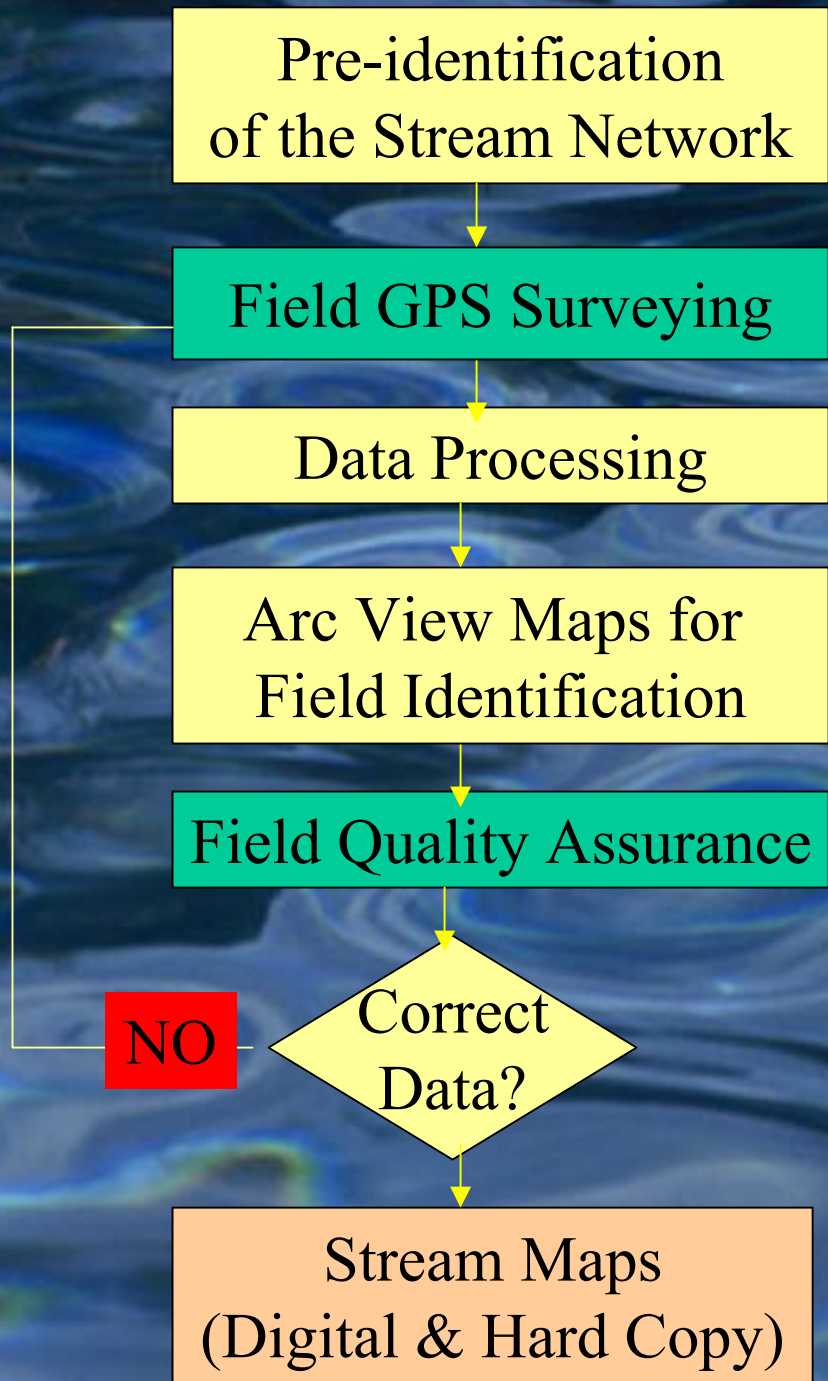
How GPS Works?

- "Triangulation" from satellites: a GPS receiver measures distance using the travel time of radio signals.
- Any delays the signal experiences as it travels through the atmosphere must be corrected.



LAWGIBB GROUP

GIS Project Components



LAWGIBB GROUP

Methodology

Presentations

- Two Public Hearings
- Two Presentations to EMC

Reports

- Drafts
- City Review
- DWQ/EMC Review
- Stakeholder Review
- Final

Maps

- Hard Copy
- Digital Format (E00 or Shape File)
- Intermittent and Perennial Streams
- Perennial Stream Segments

All final deliverables will include appropriate checks for Quality Assurance/Quality Control.

LAWGIBB GROUP

QA/QC

The execution of projects by LAWGIBB is carried out within the constraints of our internal **Quality Assurance/Quality Control** (QA/QC) procedures. These procedures are very important to the team members and provide a system of checks and balances for the execution of any project assignments.

Quality Assurance

- Provides confidence that the results, conclusions, recommendations, and products produced are **accurate** and **reliable** and conform to agreed-upon requirements and specifications, applicable standards, laws and regulations.
- Modeled after **ANSI/ASME NQA-1-1994** and **ISO 9000**.
- Applies to all services the company provides and is fully documented in our **Quality Assurance Manual**.
- Separated from branch operations at the corporate level of LAWGIBB. The corporate Director of Engineering and Science is responsible for formulation and implementation of the Corporate Quality Assurance Program.

LAWGIBB GROUP

QA/QC

Quality Control

- Each individual scientist, geologist, and technician is responsible for checking his or her own work according to LAWGIBB's QA/QC program.
- The Task Manager accomplishes an intermediate review.
- The next review, as necessary, is provided by the Project Manager to provide consistency within the contract.
- The final review, as necessary, is provided by the QA/QC Officer/Project Principal to provide consistency.

LAWGIBB GROUP